



US009410848B2

(12) **United States Patent**  
**Schilz et al.**

(10) **Patent No.:** **US 9,410,848 B2**  
(45) **Date of Patent:** **\*Aug. 9, 2016**

(54) **MOTION AND GESTURE RECOGNITION BY A PASSIVE THERMAL SENSOR SYSTEM**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/814,639**

(22) Filed: **Jul. 31, 2015**

(65) **Prior Publication Data**

US 2015/0338277 A1 Nov. 26, 2015

**Related U.S. Application Data**

(63) Continuation of application No. 14/196,151, filed on Mar. 4, 2014.

(51) **Int. Cl.**  
**G01J 5/02** (2006.01)  
**G01J 5/00** (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ..... **G01J 5/0025** (2013.01); **G01J 5/10** (2013.01); **G01P 13/00** (2013.01); **G06F 3/017** (2013.01); **G06F 3/0304** (2013.01)

(58) **Field of Classification Search**  
CPC ..... G06K 9/66; G01J 5/10  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

6,791,087 B1 9/2004 Okumura  
7,599,044 B2 10/2009 Hotelling et al.

(Continued)

**FOREIGN PATENT DOCUMENTS**

DE 102008024308 12/2009  
EP 1108324 2/2002

(Continued)

**OTHER PUBLICATIONS**

Ruser, "Object recognition with a smart low-cost active infrared sensor array," Nov. 21-23, 2005, 1st International Conference on Sensing Technology, pp. 494-499.\*

(Continued)

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(57) **ABSTRACT**

Systems and methods for recognizing motion made by a moving person are presented. The system includes a thermal sensor configured to generate a low frequency or direct current signal upon receiving thermal energy. A spatially modulating optic is disposed between the thermal sensor and the warm object. The optic is configured to modulate the thermal energy received by the thermal sensor as a function of an orientation of the moving person with respect to the thermal sensor. An electronics unit in communication with the thermal sensor includes a memory and a processor. The processor is configured by the memory to detect a change in the thermal sensor signal and recognize a characteristic of the thermal sensor signal.

**18 Claims, 7 Drawing Sheets**

